



Comparative mites and cockroaches sensitization study in three cities of Mexico

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RESUMEN

Antecedentes: en México existen pocos estudios de sensibilización a ácaros y cucarachas en pacientes con alergia respiratoria y aún menos estudios comparativos de sensibilidad a los mismos entre ciudades con diferentes características geográficas y climáticas.

Objetivos: investigar en un estudio prospectivo la sensibilidad cutánea a ocho diferentes ácaros y dos especies de cucarachas en pacientes con alergia respiratoria en tres ciudades de México: Monterrey, NL, Tampico, Tamps., e Irapuato, Gto., y determinar si existen diferencias en la sensibilización por condiciones geográficas y climáticas.

Pacientes y métodos: se practicaron pruebas cutáneas por escarificación en 58 pacientes con alergia respiratoria como asma, rinitis alérgica, rinoconjuntivitis alérgica y combinaciones de las mismas. Se practicaron las pruebas en 18 pacientes de Monterrey, 20 de Tampico y 20 de Irapuato. Los ácaros utilizados fueron: *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Blomia tropicalis*, *Tyrophagus putrescentiae*, *Lepidoglyphus destructor*, *Euroglyphus maynei*, *Acarus siro*, *Dermatophagoides microceras* y dos especies de cucarachas, *Periplaneta americana* y *Blattella germanica*.

Resultados: las reacciones más frecuentes e importantes las produjeron *D. pteronyssinus*, *D. farinae* y *E. maynei* en 40, 33 y 32 pacientes, respectivamente; después le siguieron *D. microceras* en 21 pacientes, *A. siro* en 18 y *B. tropicalis* en 13 pacientes. En Tampico el ácaro que produjo positividad cutánea más frecuentemente fue *E. maynei*, a diferencia de Monterrey e Irapuato en las que fueron *D. farinae* y *D. pteronyssinus*, respectivamente. En Tampico el ácaro *B. tropicalis* produjo positividad en ocho paciente vs sólo cuatro en Monterrey y uno en Irapuato. La respuesta cutánea a las cucarachas no fue importante y la ciudad con mayor cantidad de pruebas positivas fue Irapuato con seis pacientes a *B. germanica* y tres a *P. americana*; en Tampico cinco pacientes a *P. americana* y tres a *B. germanica* y en Monterrey la reactividad cutánea fue muy leve: sólo en dos pacientes a *P. americana* y uno a *B. germanica*. Sólo 2 pacientes de los 58 estudiados resultaron con pruebas cutáneas negativas a ácaros y alérgenos de cucarachas.

Conclusiones: sólo 2 pacientes de los 58 estudiados resultaron con pruebas cutáneas negativas, lo que demuestra la gran capacidad de sensibilización de los alérgenos de ácaros y cucarachas en los pacientes con alergia respiratoria. Aunque el grupo de pacientes es pequeño, revela que los ácaros *D. pteronyssinus*, *D. farinae* y *E. maynei* de la familia *Pyroglyphidae* son los más sensibilizantes en las tres ciudades investigadas, independientemente de las condiciones geográficas y climáticas, ya que fueron los que con mayor frecuencia produjeron reactividad cutánea y, además, produjeron las reacciones cutáneas más importante en los pacientes, con algunas diferencias en cuanto a la reactividad cutánea: en Monterrey fue mucho mayor que en Tampico e Irapuato. Aunque existe reactividad cruzada entre los ácaros de la familia *Pyroglyphidae* se sugiere incluir de rutina *E. maynei* en el panel de pruebas cutáneas que se practican a los pacientes con alergia respiratoria en las ciudades investigadas y tal vez también *B. tropicalis* en Tampico. Comparadas con los ácaros, las cucarachas produjeron escasa reactividad cutánea en los pacientes estudiados.

Palabras clave: ácaros, cucarachas, sensibilidad cutánea.

ABSTRACT

Background: In Mexico there are few research papers dealing with mites and cockroaches sensitizing in patients suffering from respiratory allergies and even less susceptibility comparative studies to the same between cities having different climatic and geographic characteristics.

Objectives: To research in a prospective study skin sensitizing to eighty different mites and two cockroaches species in patients with respiratory allergies in three cities of Mexico: Monterrey, NL, Tampico, Tamps., and Irapuato, Gto., in order to determine if there are sensitizing differences due to climatic and geographic conditions.

Patients and methods: Skin tests were performed by scarification in 58 patients suffering diverse respiratory allergies such as bronchial asthma, allergic rhinitis, allergic rhinoconjunctivitis and combinations of the same. Tests were performed on 18 patients from Monterrey, 20 from Tampico and 20 from Irapuato. Mites used were: *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Blomia tropicalis*, *Tyrophagus putrescentiae*, *Lepidoglyphus destructor*, *Euroglyphus maynei*, *Acarus siro*, *Dermatophagoides microceras* and 2 cockroaches species, *Periplaneta americana* and *Blattella germanica*.

Results: Of the total 58 patients, the most important and frequent reactions were produced by *D. pteronyssinus*, *D. farinae* and *E. maynei*, which were found in 40, 33 and 32 patients respectively, then *D. microceras* in 21 patients, *A. siro* in 18, and *B. tropicalis* in

13 patients. In Tampico, the mite with the most frequent susceptibility was *E. maynei*, in Monterrey and Irapuato the most relevant were *D. farinae* and *D. pteronyssinus*, respectively. In Tampico, *B. tropicalis* was positive in 8 patients vs only 4 in Monterrey and 1 in Irapuato. The skin response to cockroaches was not important and the city with most positives was Irapuato with 6 patients responding to *B. germanica*, and 3 to *P. americana*; in Tampico 5 patients reacted to *P. americana* and 3 to *B. germanica*, and in Monterrey skin reactivity was slight and only 2 patients reacted to *P. americana* and 1 to *B. germanica*. Only 2 patients out of 58 in the study resulted in negative skin tests to mites and cockroaches allergens.

Conclusions: Only 2 patients out of 58 in the study resulted in negative skin tests, which demonstrates the high sensibilizing capacity from mite and cockroach allergens in patients suffering from respiratory allergies. Although the patient group is small, it reveals that mites from the *Pyroglyphidae* families *D. pteronyssinus*, *D. farinae* and *E. maynei* are the most sensibilizing in the three cities under research, without regards of geographic and climatic conditions as they were the most frequent skin reactants and produced greater skin symptoms in patients, with several differences in respect to skin reactivity, as they were greater in Monterrey than Tampico and Irapuato. Although there is crossed reactivity between mites of the *Pyroglyphidae* family, it might be convenient to routinely include *E. maynei* in the skin test panel practiced to patients with respiratory allergies in the cities under research, and maybe also *B. tropicalis* in Tampico. In comparison with mites, cockroaches produced little skin reactivity in the patients.

Key words: mites, cockroaches, skin sensitivity.

Respiratory allergies prevalence such as bronchial asthma, allergic rhinitis, and allergic rhinoconjunctivitis has increased not only in industrialized countries but also in developing countries, as research from different parts of the world indicates.¹⁻⁴

Also, it has been demonstrated that one of the factors affecting development and expression of respiratory allergies are the indoor inhalant allergens such as house dust mites, and cockroach allergens. Exposure to these allergens induces sensibilization of allergic patients acting later as symptom trigger factors.⁵⁻⁷

Thirteen mite species have been found in house dust, three of which are the most common worldwide and are the most important source of mite allergens. The most common species are *D. pteronyssinus*, *D. farinae* and *E. maynei*, which are found in temperate climates. In tropical climates *B. tropicalis* of the *Echymyopodidae* family might be prevalent. Other species that might be found in house dust are from the

Glycyphagidae family such as *Lepidoglyphus destructor*, *Tyrophagus putrescentiae* and *Acarus siro* of the *Acaridae* family.^{8,9} Table 1

House dust mite growth is related to humidity and temperature. This explains the differences in sensibilization prevalence to mites by geographic regions or countries. For example, acarofauna existing in tropical and subtropical areas is different to that found in the USA and Europe.^{10,11}

Humidity is a very important factor for house dust mites, so they are prevalent in temperate climate regions maintaining enough humidity for survival. They cannot survive cold climates, dry heat or mountain climate.^{12,13}

Table 1. Most common allergy dust mites

Family and species	Genus
<i>Acaridae</i>	<i>Acarus siro</i> , <i>Aleuroglyphus ovatus</i> , <i>Tyrophagus putrescentiae</i> , <i>Suidasia Medanensis/pontifica</i>
<i>Echimyopodidae</i>	<i>Blomia tropicalis</i> , <i>Austroglyphus malaysiensis/geniculata</i>
<i>Glycyphagidae</i>	<i>Glycyphagus domesticus</i> , <i>Lepidoglyphus destructor</i>
<i>Pyroglyphidae</i>	<i>Dermatophagoides pteronyssinus</i> , <i>Dermatophagoides farinae</i> , <i>Dermatophagoides microceras</i> , <i>Euroglyphus maynei</i> , <i>Stumophagoides brasiliensis</i> , <i>Malayoglyphus intermedius</i>
<i>Cheyletidae</i>	<i>Cheyletus</i> sp
<i>Tarsonemidae</i>	<i>Tarsonemus</i> sp

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Although *D. pteronyssinus* is one of the most important house dust mites in the world, other species such as storage mite *Blomia tropicalis* is very common in Costa Rica and other Latin American areas.^{14,15} *Dermatophagoides farinae* is found easier in dry regions.¹⁶

Beside house dust mites, there are other important indoor inhalant allergens for allergic respiratory disease such as allergens from cockroaches. It has been shown that exposure to cockroach allergens might sensitize allergic patients and it is a risk factor for bronchial asthma.¹⁷⁻¹⁹

The two most common cockroach species in the Western world are *Periplaneta americana* and *Blatella germanica*.

In the present study we attempt to determine if there are differences in skin sensibility to dust mites and cockroaches in three patient groups suffering from respiratory allergies, in three Mexican cities with climatic and geographic differences.

PATIENTS AND METHODS

Fifty-eight patients suffering respiratory allergies such as rhinitis, rhinoconjunctivitis and bronchial asthma in three Mexican cities with climatic and geographic differences. The group consisted of 20 patients from Tampico, Tamaulipas, a sea side city on the Gulf of Mexico to the Northeast of the country, with a predominantly hot sub humid tropical climate, average yearly temperature of 24 °C, Northern winds during autumn and winter, yearly rainfall between 800 and 1000 cubic millimeters, and average relative humidity of 77-78%; 20 patients from Irapuato, Guanajuato, a city located on the central Mexican plateau, at 1,720 m asl, with a sub humid temperate climate averaging between 18-20 °C, a benevolent rain cycle and a "mild" winter. Yearly rainfall from 600 to 700 cubic millimeters and 56% average relative humidity; and 18 patients from Monterrey, Nuevo Leon, a city located on the Northeast plains, a semi desert area with hot dry climate, an average yearly temperature of 22 °C, with highs in around 40 °C in summer and 2 °C in winter. Found at an altitude of 537 meters above mean sea level. Rainfall varies by zone from 200 mm to 1,000 mm, but the relative humidity average is 56%.

The Tampico group consisted of 16 females and 4 males with a median age of 31 years; the Irapuato group consisted of 12 males and 8 females with a median age of 31 years; and the Monterrey group consisted of 10 females and 8 males with an average age of 27 years.

Scarification testing on the volar surface of the forearms using a Duotip-Test applicator from Lincoln Diagnostics and a battery of skin tests using standardized extracts from Laboratorios LETI from the following mite species: *Dermatophagoides pteronyssinus* (*D. pteronyssinus*), *Dermatophagoides farinae* (*D. farinae*), *Blomia tropicalis* (*B. tropicalis*), *Tyrophagus putrescentiae* (*T. putrescentiae*), *Lepidoglyphus destructor* (*L. destructor*), *Euroglyphus maynei* (*E. maynei*), *Acarus siro* (*A. siro*) and *Dermatophagoides microcera* (*D. microcera*). Two allergen extracts in 1 mg/mL from cockroach species were investigated also: *Periplaneta americana* (*P. americana*) and *Blatella germanica* (*B. germanica*). Glycerinated histamine was applied as positive control and glycerin as negative control.

Reactions were read at 15 minutes, and were considered positive if the reaction wheal was larger than 3 mm.

RESULTS

In Monterrey, the mites with the greater skin reactivity response frequency and intensity were: *D. farinae* in 16 of 18 patients (88%), *D. pteronyssinus* in 15 of 18 (83%), *E. maynei* in 15 of 18 patients (83%) and *D. microcera* in 14 of 18 (77%) later, *A. siro* in 8 patients and *B. tropicalis* in only 4.

In Irapuato, 14 of 20 patients showed greater reactivity to *D. pteronyssinus* (70%), *D. farinae* in 12 of 20 (60%), and the remainder mites only *E. maynei* in four other patients.

In Tampico, findings differed slightly even if the predominant response came from *E. maynei* with 13 positives out of 20 patients (65%), *D. pteronyssinus* in 11 of 20 patients (55%), also from the *Pyroglyphidae* family, *A. siro* from the *Acaridae* family in 9 of 20 patients (45%) and it was the city where more reactions were found to *B. tropicalis* from the *Echimyopodidae* family in 8 of 20 patients (40%). It was also the city

Table 2. Findings of skin reactivity in cities under research

Allergens	Monterrey, Nuevo Leon No. of patients	Tampico, Tamaulipas No. of patients	Irapuato, Guanajuato No. of patients
<i>Dermatophagoides pteronyssinus</i>	15	11	14
<i>Dermatophagoides farinae</i>	16	5	12
<i>Blomia tropicalis</i>	4	8	1
<i>Tyrophagus putrescentiae</i>	4	4	1
<i>Lepidoglyphus destructor</i>	4	8	0
<i>Euroglyphus maynei</i>	15	13	4
<i>Acarus siro</i>	8	9	1
<i>Dermatophagoides microceras</i>	14	6	1
<i>Periplaneta americana</i>	2	5	3
<i>Blatella germanica</i>	1	3	6

where more reactions were found to *L. destructor* from the *Glycyphagidae* family in 8 of 20 patients (40%).

Table 2

Most of the patients in the three cities showed greater and more frequent skin reactivity to mites from the *Pyroglyphidae* family such as *D. pteronyssinus* in 40 of 58 patients, *D. farinae* in 33 of 58 patients and *E. maynei* in 32 of 58 patients. Tampico, Tamaulipas was the city where more reactions were found to *B. tropicalis*.

Mite skin reactivity was most important in patients from Tampico and Monterrey when compared to Irapuato.

Regarding cockroach allergens, skin reactivity to *Periplaneta americana* and *Blatella germanica* antigens was little in general when compared to mite skin reactivity, and was found more frequently and greater in Irapuato with 6 of 20 patients showing a positive reaction to *Blatella germanica* and 3 to *Periplaneta americana*. In Tampico, 5 patients had mild reactions to *P. americana* and 3 to *B. germanica*. In Monterrey, only 2 patients showed mild skin reactions to *P. americana* and 1 to *B. germanica*. Table 3

From all the patients participating in this study, only 2 had completely negative skin tests to mites and cockroaches, from the Monterrey group.

Although important mite skin reactivity was detected on patients from 11 to 58 years old, the greatest number of patients with large wheal size from the skin tests was between 15 and 30 years of age, and these were produced by *D. pteronyssinus*, *D. farinae* and *E. maynei*.

Table 3. Most important and frequent reactions in skin test in study

<i>Dermatophagoides pteronyssinus</i>	40
<i>Dermatophagoides farinae</i>	33
<i>Euroglyphus maynei</i>	32
<i>Dermatophagoides microceras</i>	21
<i>Acarus siro</i>	18
<i>Blomia tropicalis</i>	13
<i>Lepidoglyphus destructor</i>	12
<i>Tyrophagus putrescentiae</i>	9
<i>Periplaneta americana</i>	10
<i>Blatella germanica</i>	10

DISCUSSION

Out of the 58 patients with respiratory allergies in this study, only 2 resulted in negative skin tests for dust mites and cockroaches, which confirms the high incidence where these allergens may sensitize allergic patients and trigger symptoms as demonstrated by other authors.⁵⁻⁷

In the present study the house dust mites found with most frequency in the tests and produced the largest skin reactivity were from the *Pyroglyphidae* family: *D. pteronyssinus*, *D. farinae* and *E. maynei*. These mites are the most common worldwide in respiratory allergies, and they develop mostly in temperate climates. *B. tropicalis* is frequent in tropical or subtropical climates⁸ and it has been shown that it is an important source for indoor inhalant allergens associated with asthma and rhinitis in the tropics.²²⁻²⁴ The greater number of patients sensitized to *B. tropicalis* in our study was found in Tampico, in 8 out

of 20 patients, vs 4 in Monterrey and none in Irapuato. Additionally, Tampico was the only city where 40% of the patients was sensitized to mites from other families such as *A. siro* of the *Acaridae* family and *L. destructor* of the *Glycyphagidae* family. This might be explained by the higher average relative humidity of the environment in Tampico when compared to Monterrey and Irapuato. Some authors recognize that cross reactivity is a common finding between mite allergens, especially in those species taxonomically related such as *D. pteronyssinus*, *D. farinae*, and *E. maynei*,^{20,21} but due to the high frequency found for *E. maynei* in the sensitivity skin testing it is recommended to be included in the regular test panel for patients with respiratory allergies.

In this study, skin test sensitization to cockroach allergens is low. Sensitization prevalence to these allergens as with dust mites is directly correlated to exposure⁶ and it has been demonstrated that there is greater sensitization to cockroaches in poor socioeconomic strata.^{7,25} Patients under study came from private practice offices, that is, from better socioeconomic standing, and probably with less exposure to cockroaches in comparison to patients seen in public hospitals where sensitization to them is higher,²⁶ which probably explains our results in regards to cockroach allergens.

CONCLUSIONS

Although the patient number is small and only from three cities in Mexico, the geographic and climatic differences and our results demonstrate the ubiquity and capacity for development and sensitization of house dust mites especially from the *Pyroglyphidae* family, thus it would be convenient to include *E. maynei* in the respiratory allergy patient skin test panel besides *D. pteronyssinus* and *D. farinae* and probably in tropical and subtropical zones to *B. tropicalis*, as well as practicing sensitization studies in these zones with mites from other families such as *Acaridae* and *Glycyphagidae*, as the high environmental relative humidity might facilitate their development.

In relation to the results from the cockroach allergens, further comparative studies are necessary between the lower socioeconomic stratus of society (with higher exposure probability to cockroaches) who in general are

seen in public hospitals and institutions, and population from mid to higher socioeconomic strata (less probability of roaches exposure) from private practice or hospitals to determine if it is necessary to routinely include roach allergens in skin testing.

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